NORTHEAST WASTEWATER TREATMENT PLANT

URBANA & CHAMPAIGN SANITARY DISTRICT, UCSD

1100 E. University Avenue
Urbana, Illinois

Plant History

The district was organized in 1922 and dedicated its first treatment plant known today as the Northeast Plant, NEP, in 1924. Growth of the service area which includes the City of Urbana, the City of Champaign, the University of Illinois campus, the Village of Savoy and surroundings, resulted in the construction of a second treatment plant in 1968. The Southwest Plant, SWP, treats about 6 million gallons of wastewater per day (MGD).

Service Area

The NEP serves the City of Urbana, eastern portion of the City of Champaign, and the University of Illinois at Urbana-Champaign campus. Average daily flow is between 13 to 14 MGD.

Type of Treatment

The NEP is designed to provide preliminary, primary, secondary, ammonia, and tertiary treatments prior to discharge into the Saline Branch Drainage Ditch. The wastewater sludge generated by it and the Southwest Plant's secondary sludge are treated and dewatered at the facility. A SCADA (supervisory control and data acquisition) computer program is used to aid the operations staff in maintaining and controlling the treatment plant's processes. The following sequence follows the flow through the plant.

Screening & Grit Removal, Station B

Five large interceptor sewers bring the wastewater from the network of smaller collector sewers within the service area into the Headworks Building where it is screened for removal of rags, plastic, and other solid debris. After the water is screened, it flows into two, side-by-side grit removal tanks for the removal of sand, small stones, and other small debris such as eggshells.

Primary Treatment

The water then flows into one of two primary settling clarifiers. These tanks remove about half of the solids contained in the water flowing into the treatment plant. They are purely sedimentation basins where the flow no longer speeds its way through the process allowing the solids to quietly settle to the bottom of the tank. The solids collected from the bottom of the tank are pumped to a solids blending tank, KK1, for treatment by the solids handling processes. The effluent from these primary clarifiers is rich in soluble and solid carbon sources.

Secondary Treatment, Trickling Filter

Flow from one of the primary clarifiers, GG1, travels to Station A where pumped it is for treatment in the trickling filter. The trickling filter is a 1.6-acre tank where the pumped water flows through numerous sprinklers on the surface

of the trickling filter. The trickling filter is filled with crushed stone to allow bacteria to grow on the surface of the stones. The crushed stone is large enough to allow a good supply of air to follow the water as it cascades through the rocks. Bacteria consume the carbon materials in the wastewater as it drains over the rocks that they live on. During normal dry weather operation, the flow from the trickling filter is returned to Station F and further treated by the activated sludge process.

Secondary Treatment, Activated Sludge

Flow from the primary clarifier, GG2, also travels to Station F and the screw pumps. The screw pumps lift the treated water to the activated sludge tanks. This plant uses the contact stabilization method of operating its secondary treatment system in a series of aeration tanks. There are four aeration tanks in series and the first tank holds bacteria, allowing them to rest and metabolize the absorbed food before they are reintroduced to the process. Primary effluent is introduced to the bacteria in the second aeration tank. The amount of air in each tank is adjusted by SCADA and the flow of water snakes its way through the third and fourth tanks. The activated sludge tanks contain a mix of microorganisms, including bacteria and protozoans. This process biologically removes the carbon sources from the wastewater as they do in nature.

Secondary Clarifiers

Flow from the aeration tanks travels by gravity to four secondary clarifiers where the bacteria and protozoans can settle to the bottom of the clarifier by gravity. Pumps return the settled solids to the first aeration basin to further treat incoming wastewater. Since there are many bacteria present in the secondary process and they proliferate rapidly, about one fifth of their population are removed daily to the solids handling portion of the process.

The trickling filter flow train has two secondary clarifiers to remove any bacteria that may slough off the rock. These are used during a storm when the activated sludge process is at its maximum capacity.

Nitrification Towers

Flow from the secondary clarifiers travels to the nitrification pump station and is pumped to the top of two nitrification towers, where toxic ammonia in the wastewater is converted to non-toxic nitrates by another group of microorganisms growing on the media in the towers.

Tertiary Filters

Flow exits the towers and travels by gravity to the tertiary filter building, Station X. There are nine filtering units, each containing 12 disks covered with filter cloth that traps any remaining suspended solids on the surface of the cloth.

Disinfection & Flow Measurement

The filtered water travels to a Parshall flume, which measures the flow rate, before passing through the chlorine contact tank. Seasonally chlorine must be added to the treated water to kill most of the bacteria that remain in the water. This is done during the warmer months of the year. Sodium bisulfite is added to the final water to remove the toxic effect of the chlorine before discharging it to the Saline Ditch.

Excess Flow Treatment

During a storm event when flow exceeds the maximum capacity of complete treatment, excess flow is diverted to two excess flow clarifiers and disinfected.

Solids Handling

The secondary sludge from the aeration system is treated with polymer and the excess water is removed by a gravity belt thickener or GBT. Primary sludge and the GBT solids from the NE and SW treatment plants are pumped into a sludge holding tank, KK1. The combined sludge is pumped into four digesters to remove some of the volatile solids in the sludge. By heating and circulating the sludge in the digesters, a gas mixture of methane and carbon dioxide is formed. This gas mixture is burned in stationary engines with generators to produce electricity and heat for the treatment process.

After about a month in the digesters the sludge is removed by pump to a short-term storage tank. The digested sludge must be dewatered to reduce the cost of disposal. The district uses centrifuges and polymer to separate the remaining biosolids from the water in the anaerobically digested sludge. Dewatered biosolids are applied to land as a soil supplement or hauled to a landfill.